



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
General Certificate of Education  
Advanced Subsidiary Level and Advanced Level

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**THINKING SKILLS**

**9694/12**

Paper 1 Problem Solving

**October/November 2013**

**1 hour 30 minutes**

Additional Materials:      Multiple Choice Answer Sheet  
   Soft clean eraser  
   Soft pencil (type B or HB is recommended)

\* 5 8 5 4 0 3 9 6 7 8 \*

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**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name on all the work you hand in.

There are **30** questions on this paper. Answer **all** the questions.

For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in pencil on the separate answer sheet.

**Read very carefully the instructions on the answer sheet. Ignore responses numbered 31 – 40 on the answer sheet.**

**DO NOT WRITE IN ANY BARCODES.**

**INFORMATION FOR CANDIDATES**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

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This document consists of **20** printed pages.



- 1 Three batteries with voltages 1.5, 4.5 and 6 volts can be connected in a line with each battery either way round.



When batteries are facing the same way, their voltages add together. When one battery is in the opposite direction to the other two, its voltage is subtracted from their sum.

Which of these voltages can **not** be made using all three batteries in a line?

- A 3
  - B 6
  - C 9
  - D 12
- 2 An improvement to the Z50 motorway is to be made by tunnelling through a hillside, which will cut journey times by 30 minutes. Team A will tunnel from the Carlton end and Team B from the Hipstone end, and they will meet somewhere in between. Team A can tunnel twice as fast as Team B.

Which one of the following further pieces of information would be sufficient to determine how far from the Carlton end they will meet?

- A The distance between the Carlton and Hipstone ends
- B The speed of progress of Team A
- C The distance achieved by each team after one month
- D The speed of progress of Team B

- 3 A carpenter needs to keep a supply of three standard Phillips-head screw sizes. He needs one size from each of the following ranges: M4 – M10, M12 – M20 and M24 – M50. His supplier provides the following table of available screw sizes.

<i>Name</i>	<i>Diameter</i>	<i>Price for 50 screws</i>	<i>Number in stock</i>	<i>Flat- or Phillips-head?</i>
M4	4	\$9.90	360	Flat
M5	5	\$12.80	510	Both
M6	6	\$10.30	243	Flat
M8	8	\$12.10	725	Phillips
M10	10	\$17.50	1003	Phillips
M12	12	\$19.10	660	Flat
M14	14	\$22.00	824	Phillips
M16	16	\$24.50	530	Both
M18	18	\$26.00	841	Both
M20	20	\$31.10	200	Both
M24	24	\$34.30	462	Phillips
M28	28	\$39.70	730	Phillips
M36	36	\$42.60	476	Both
M50	50	\$45.10	810	Flat

Which of the following screw size combinations would be suitable?

- A M5, M14 and M50  
 B M6, M16 and M28  
 C M8, M18 and M36  
 D M10, M12 and M24
- 4 A self-storage company provides storage space of 5.0 m x 5.0 m x 5.0 m. A customer has 400 boxes measuring 0.5 m x 0.5 m x 1.0 m and 100 boxes measuring 1.0 m x 1.0 m x 1.0 m. All of the smaller boxes must be stored in this storage facility.

How many of the larger boxes will **not** fit into the storage facility?

- A 0  
 B 50  
 C 75  
 D 100

- 5 Groups of organic chemicals have a general mathematical formula which applies to all members of the group. So, suppose that molecules such as  $C_nH_n$  exist. If  $n$  was equal to one then the molecule would have one carbon atom and one hydrogen atom, that is  $C_1H_1$ . The next member of the group would have two of each type of atom,  $C_2H_2$ , the third would have three of each type,  $C_3H_3$ , and so on as the organic molecule increases in length.

The first four members of a group of organic chemicals known as the *alkanes* are as follows:

<i>Molecular formula</i>	<i>Name</i>
$CH_4$	methane
$C_2H_6$	ethane
$C_3H_8$	propane
$C_4H_{10}$	butane

Which of the following represents the general formula of the *alkanes*?

- A  $C_nH_{2n-1}$   
 B  $C_nH_{2n}$   
 C  $C_nH_{2n+1}$   
 D  $C_nH_{2n+2}$
- 6 Lucky Linda and Fortunate Fred are racehorses. Each of Lucky Linda's strides covers twice as much ground as each of Fortunate Fred's strides. The course they are running on is 2 km long. Fortunate Fred and Lucky Linda are the only two runners in their race and each starts at exactly the same moment. Fortunate Fred always takes 3 strides for every 2 that Lucky Linda takes.

If both horses complete the course, what is the most likely result of the race?

- A Fortunate Fred will win by  $\frac{1}{2}$  km  
 B Fortunate Fred will win by  $\frac{2}{3}$  km.  
 C Lucky Linda will win by  $\frac{1}{2}$  km.  
 D Lucky Linda will win by  $\frac{2}{3}$  km.

- 7 I needed to store 18 large parcels, each measuring 1 m x 1 m x 2 m. My friend owns a sliding-door container, with a floor area of 9 square metres. He cannot remember its height, but does remember that all the container's internal dimensions are an exact number of metres. Workers packed my parcels, all standing upright, into his container and, by sheer good fortune, they fitted in exactly, with no wasted space at all.

Sometime in the future I will need to store a large number of smaller parcels, each one a cube with a volume of 1 cubic metre. I would like to know in advance if they will fit into his container.

Which one of the following pieces of information must be known before it can be determined whether my parcels will fit into his container?

- A Both the length and the breadth of the container's floor
- B The height of the container
- C The number of items packed into each of the smaller parcels
- D The number of smaller parcels to be stored in the container

- 8 A scholar is convinced that three of William Rockjavelin's last four plays are forgeries, written by Baron Land. He employs a test based on various features of Rockjavelin's writings – the average length of sentences, the number of adjectives used per page and so on. These are the figures he worked out for Rockjavelin's known writings:

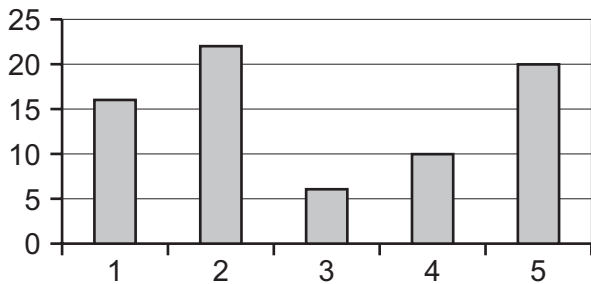
1	Average sentence length	21.6
2	Average number of adjectives per page	12.8
3	Ratio of scenes to acts	6.7
4	Average number of letters in a word	5.6
5	Frequency of the use of the word "the" per 500 words	17.5

The results of the tests on the last four plays are shown below.

Which one of the plays is Rockjavelin most likely to have written?

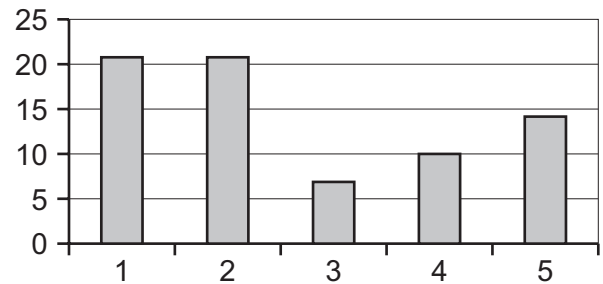
**A**

Three ruffians of Scunthorpe



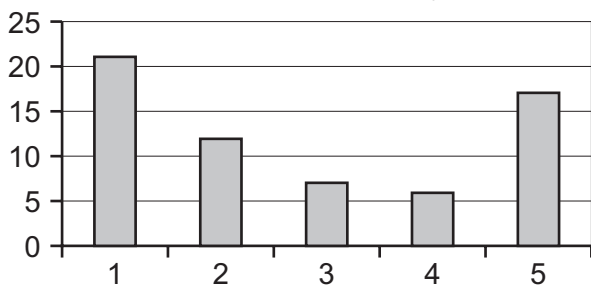
**B**

The miserable old women of Windsor



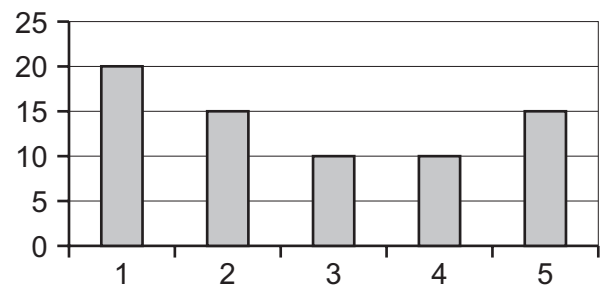
**C**

A lot of fuss about very little



**D**

The meerkat of Venice



- 9 If I send a tuck box to my son, his school's rules state that it must contain at least 3 sweets for each of the other 25 boys in his class and must not contain more than 10 sweets for my son. Wine gums and sherbet dips are not allowed and the school will remove them from the tuck box before the sweets are distributed. Unfortunately, I had packed and sent the tuck box before I knew all this. It contained 10 wine gums, 25 cough candies, 25 barley sugars, 10 sherbet dips and 10 chocolate discs.

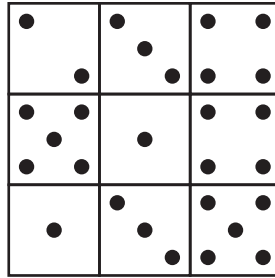
What is the minimum number of sweets I should have added to the tuck box in order to comply with the school rules?

- A 0
  - B 15
  - C 19
  - D 25
- 10 From Monday to Friday Anne makes souvenirs to sell in her shop. Each souvenir takes 40 minutes to make and Anne does not start to make a souvenir if she does not have time to complete it that day. Anne makes the souvenirs between 9 am and 5 pm each day, but she stops for at least 30 minutes for lunch.

What is the largest number of souvenirs that Anne could produce in a week?

- A 55
- B 56
- C 57
- D 60

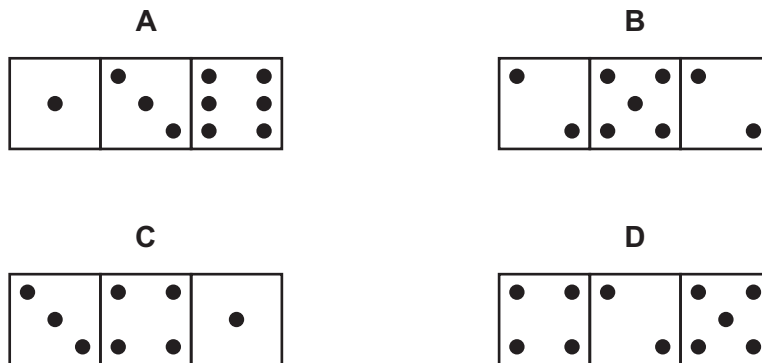
11



This is a bird's eye view of nine dice on a table. They are regular dice with the sum of dots on opposite faces always equal to seven.

The dice are viewed from the side at table-top level.

Which one of the following might you see?



- 12 I recently visited a supermarket which stocks the items shown below. I bought two of one item, none of one item, and one of each of all the remaining items. I spent exactly \$8.80.

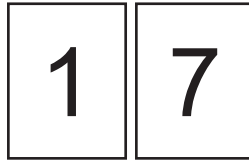
Bananas	\$1.70
Bread	\$1.10
Tomatoes	\$0.90
Cooking oil	\$2.60
Soap	\$1.00
Water	\$0.60

Which item did I not buy?

- A Bananas
- B Bread
- C Tomatoes
- D Cooking oil



- 13 The spaces in a car park need to be numbered (starting at 1) using cards, each of which has a single digit on it. For example, the number 17 appears as shown below.



In total 157 cards will be needed.

How many 4s will be needed?

- A 10  
 B 16  
 C 18  
 D 36
- 14 There are four Political Parties in Cyclonia. They are the Levant Party, The Mistral Party, the Sirocco Party and the Zonda Party.

Cyclonia has a National Parliament, and also each of its four Provinces has its own Provincial Assembly.

The National Parliament has 360 seats, and the current state of the Parties is:

Sirocco – 173 seats  
 Mistral – 112 seats  
 Zonda – 46 seats  
 Levant – 29 seats

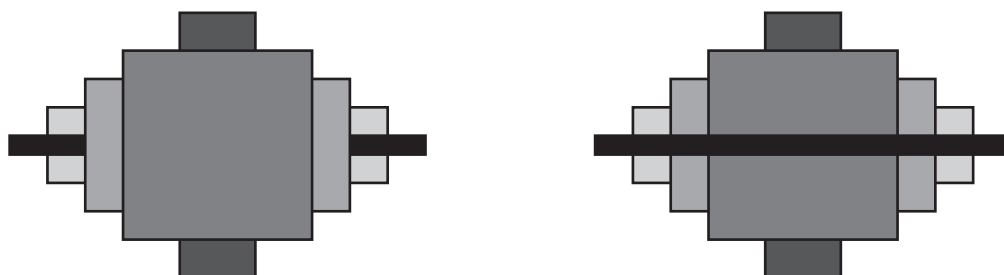
In the Provincial Assemblies the seats held by each party are:

	Sirocco	Mistral	Zonda	Levant
Northern Province (80 seats)	38	26	11	5
Eastern Province (108 seats)	70	48	16	10
Southern Province (120 seats)	58	37	15	10
Western Province (90 seats)	43	30	11	6

For which Province would a pie chart of the state of the parties most closely resemble a pie chart of the state of the parties in the National Parliament?

- A Northern Province  
 B Eastern Province  
 C Southern Province  
 D Western Province

- 15 A package for computer graphics allows objects to be either pulled to the front or pushed to the back of a group.



What is the greatest number of pulls and/or pushes needed to rearrange a figure with five components to any other?

- A 2  
 B 3  
 C 4  
 D 5
- 16 Jasmine, Nathan and Zachary like to walk a different way to the same school each day. Jasmine always leaves for school at least 2 minutes before Nathan and Zachary, who leave together. Their journey times in minutes are shown in the table below.

	<i>Monday</i>	<i>Tuesday</i>	<i>Wednesday</i>	<i>Thursday</i>	<i>Friday</i>
<i>Jasmine</i>	8	10	7	8	10
<i>Nathan</i>	12	11	6	6	4
<i>Zachary</i>	10	8	7	8	10

One day they all arrived within 3 minutes of each other.

Which of the following further pieces of information would always be sufficient to determine which day this was?

- A Jasmine's journey time.  
 B Nathan's journey time.  
 C Zachary's journey time.  
 D The number of minutes Jasmine left before Nathan and Zachary.

- 17 The Fliffton Pedalo Racing Championship is contested annually by twenty competitors over ten heats. Points are awarded in each heat as follows.

<i>Position</i>	<i>Points</i>
1st	15
2nd	12
3rd	9
4th	7
5th	5
6th	3
7th	2
8th	1

The same eight competitors have scored points in both of the heats held so far this year. This is the current situation.

A. Jameson	24 points
J. Lewin	20 points
G. Islet	17 points
L. Bail	14 points
I. Loxpun	13 points
P. Milknett	11 points
S. Lucia	5 points
F. Duncan	4 points

Who is the only point-scoring competitor to have finished both heats in the same position?

- A Bail
- B Duncan
- C Jameson
- D Lewin

- 18 Budget airlines keep their fares low by making individual planes fly as many journeys as possible each day. Based at Birmingham Airport, no flights are allowed to leave before 06:00 and they must return by 23:00. At each airport visited the plane has a 30 minute refuelling and rest stop. Below is a list of possible destinations and the journey time for each.

Birmingham (GB) – Geneva	100 mins	Liverpool – Geneva	120 mins
Birmingham(GB) – Grenoble	100 mins	Nice – Paris	35 mins
Geneva – Paris	60 mins	Bristol (GB) – Rome	150 mins
Geneva – Nice	60 mins	Rome – Athens	125 mins
Grenoble – Bristol (GB)	100 mins	Athens – Paris	145 mins
Grenoble – Liverpool(GB)	120 mins		

Each journey can be flown in both directions. At the end of the day the aircraft returns to Birmingham.

What is the maximum number of journeys possible between 06:00 and 23:00?

- A 13  
 B 14  
 C 22  
 D 24
- 19 Before matches played yesterday in the Melangian Football League, Atletico were top of the table with 57 points, followed by Rapid (55 points), Spartak (53 points) and Partizan (52 points). Now, all four clubs have 58 points.

The results of the matches played yesterday that involved these clubs were as follows.

Atletico	1	Spartak	2
Partizan	3	Standard	0
Rapid	0	Dynamo	0

5 points are awarded for a win, and both teams receive 2 points for a drawn match. In addition, either team may qualify for 1 or 2 bonus points (whether they win, draw or lose the match), or both teams may qualify for 1 bonus point each.

Which of the following could explain the points gained by the top four clubs yesterday?

- A 1 bonus point for each of the first two goals of the match.  
 B 1 bonus point for leading at half-time; 1 bonus point for conceding no goals.  
 C 1 bonus point for leading at half-time; 1 bonus point for the first goal of the match.  
 D 1 bonus point for the first goal of the match; 1 bonus point for conceding no goals.

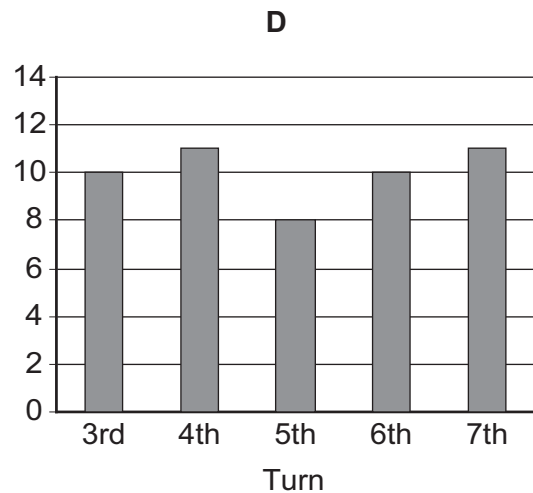
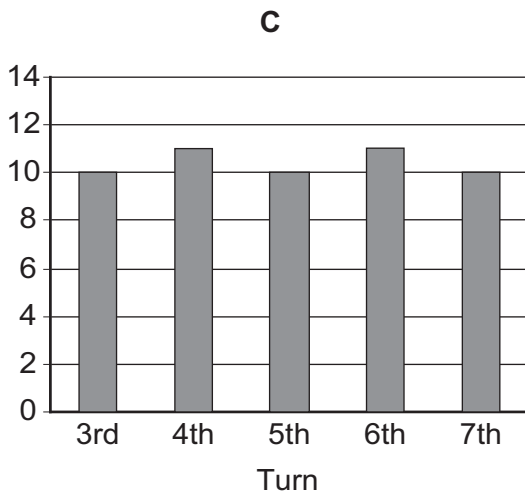
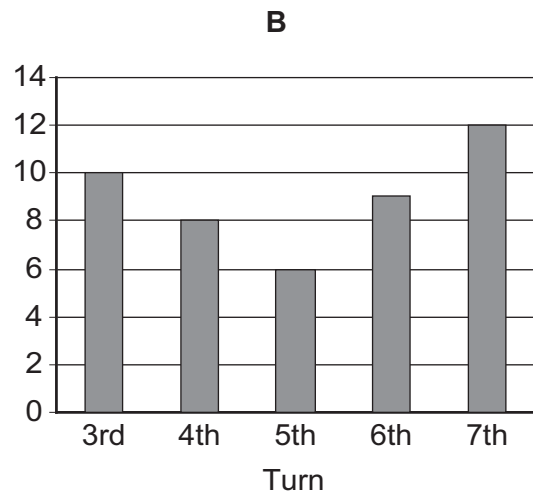
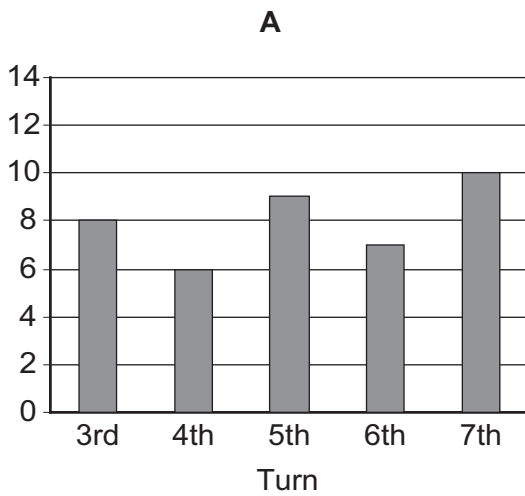
20 Tim and Tom have borrowed a jar of beans and a die from their mother and are playing a simple game. The rules of their game are as follows.

At the start of the game each player takes 10 beans from the jar. Then they take turns and, at his turn, each player throws the die.

- If he throws a 2, he returns two beans to the jar.
- If he throws a 4 or a 6, he returns one bean to the jar.
- If he throws a 3, he takes three beans from the jar.
- If he throws a 1 or a 5, he takes one bean from the jar.

The first player to be left with no beans wins the game.

Which one of the following charts could **not** represent the number of beans held by Tim during part of the game?



- 21 Wesley and Eamonn live 5 kilometres from each other, both on the main road that runs through Longtown. They both left home at 11:05 this morning in order to meet each other at Longtown Library, 2 kilometres from Wesley's home. They both walked at the same speed throughout, and at the same speed as each other. Wesley spent 4 minutes in a shop on the way, but still arrived at the library 7 minutes before Eamonn.

At what time did Wesley and Eamonn meet?

- A 11:26  
 B 11:31  
 C 11:38  
 D 11:45
- 22 Canal building was a very expensive task. Digging the route cost \$10 000 per kilometre. In addition to this:
- locks cost \$15 000 each;
  - tunnels cost \$20 000 per 100 metres;
  - aqueducts cost \$25 000 per 100 metres.

Four routes for a new canal from Leek to Uttoxeter were suggested.

Which route would have been the least expensive to build?

<i>Route</i>	<i>Length</i>	<i>Locks</i>	<i>Tunnels</i>	<i>Aqueducts</i>
<b>A</b>	40 km	8	3 x 600 m	1 x 600 m
<b>B</b>	45 km	6	2 x 400 m	2 x 400 m
<b>C</b>	50 km	8	3 x 200 m	3 x 200 m
<b>D</b>	80 km	6	2 x 400 m	1 x 500 m

- 23 I need to make some photocopies ready for a meeting next week and I have been given these prices by the local company.

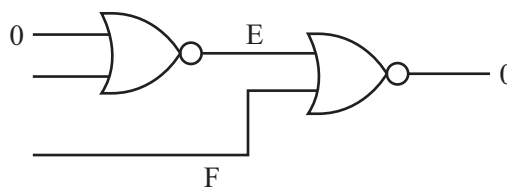
<i>Number of copies</i>	50	100	200	500	1000
<i>Price (\$)</i>	25	30	40	45	70

Prices for photocopying are calculated from a cost per sheet and may also include a fixed charge for the service. Sometimes there is an offer that the price is reduced when the order is more than a certain amount. In such cases the reduced price applies to all copies in the order.

Which of the following could describe the way in which the prices for photocopying are determined?

- A** No fixed charge for the service and a reduction in the price per sheet if the order is more than 250 copies.
- B** A fixed charge for the service and a reduction in the price per sheet if the order is more than 250 copies.
- C** A fixed charge for the service, but the fixed charge is not applied if the order is more than 250 copies.
- D** A fixed charge for the service and a percentage reduction on the overall price if the order is more than 250 copies.
- 24 The following question with a diagram appeared in an examination, but the value of one of the inputs was missing.

The earliest integrated circuits were made up from a simple component called a 'nor' gate. Each wire has a voltage representing either On (1) or Off (0). A 'nor' gate gives an output (on the right) of 0 unless both inputs (on the left) are 0, in which case the output is 1.

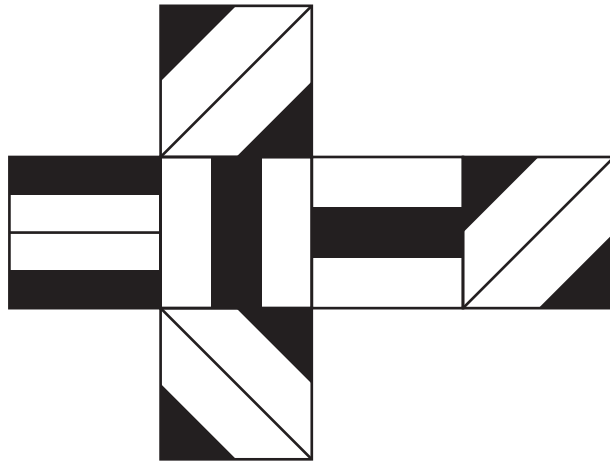


What are the values of E and F?

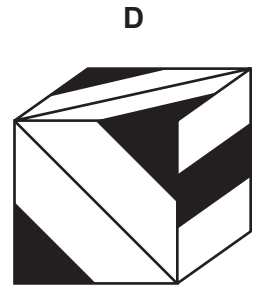
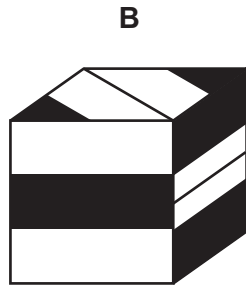
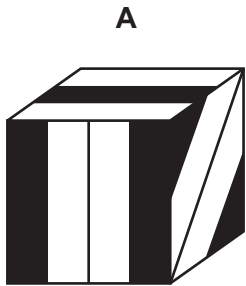
Only one value for a missing input leads to a unique answer to the question. Assuming this value is the one intended, what are the values of E and F?

- A** E = 0, F = 0
- B** E = 0, F = 1
- C** E = 1, F = 0
- D** E = 1, F = 1

25 The diagram shows the net of a cube, which is blank on the other side.



Which one of the following could be a view of the cube?

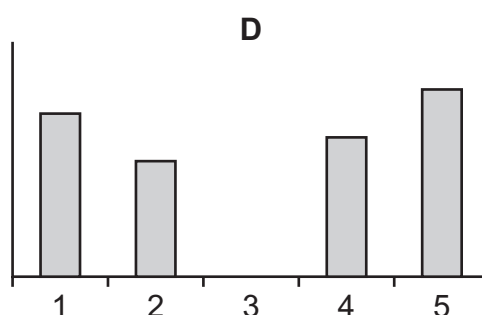
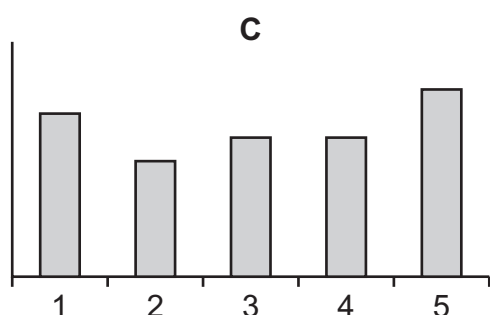
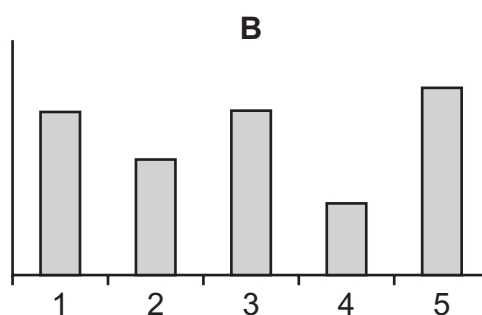
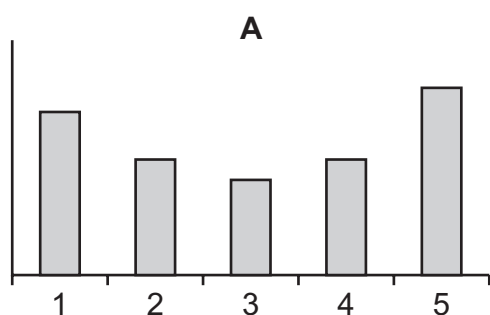




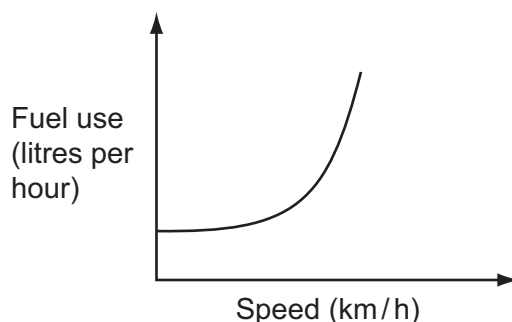
- 26 In my local village hall there has been a collection for charity over the last five weeks. At the end of each week the total donated so far has been displayed. I recorded the amounts each week, but did not go to the hall in week 3 and so I do not know what the number was in that week. The table below shows the amounts displayed on each of the weeks.

Week	1	2	3	4	5
Total	\$70	\$120		\$220	\$300

Which of the following charts could represent the amount donated each week?

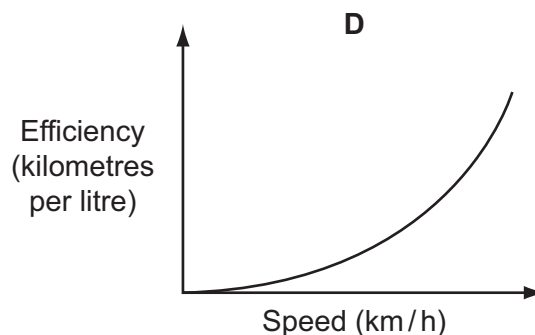
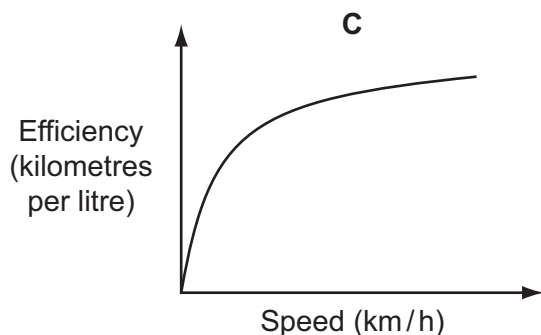
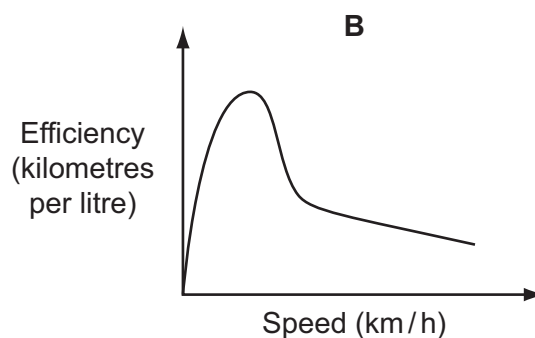
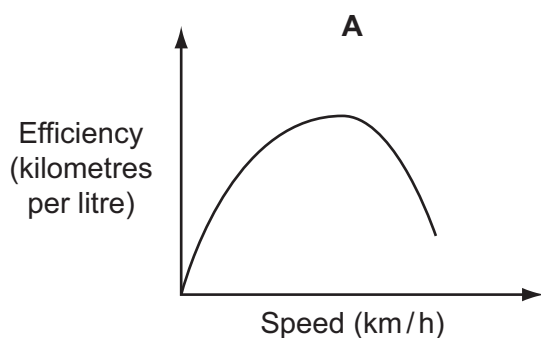


- 27 The amount of fuel a vehicle uses depends upon its speed. Below is a graph, for a particular vehicle, of how the amount of fuel it uses per hour varies with the steady speed of the vehicle.



Jim is keen to know about the performance of the vehicle, in terms of how its fuel efficiency (the number of kilometres travelled for each litre of fuel used) varies with its steady speed.

Based on the information given above, which of the graphs below best represents the performance of the vehicle?



- 28 Vivek fancied a new laptop costing \$700.00. He had been saving hard throughout the holidays, but was still short of \$270.00. He took up casual evening work after school, Monday to Friday, at a local factory assembling kettle parts. Each assembly earned him \$2.50 per kettle up to 10 kettles. Over that number he was paid in addition a bonus of \$1.20 per kettle. He could assemble 13 kettles per evening. After 6 evenings of work he stayed away for three days owing to a toothache.

If he had started work on Monday, 6th October, on what date would he have earned enough money to quit, assuming that he did not take any other time off?

- A 20th October
- B 21st October
- C 22nd October
- D 23rd October

- 29 In a particular game matches are played between two players over a series of rounds. At the end of any round one player will score 1 point and the other player will score 0. Draws are not possible. If a player's score is three points more than their opponent then the match ends with a win for that player. If a total of 7 points are scored then the match automatically ends with a win for the player in front.

Four friends recently played this game in a knockout tournament. Jason and Karen both won their first matches and so played each other in the final. Jason was disappointed because he lost the final, but scored more points in total in the tournament than Karen did.

How many points were scored in total over the three matches?

- A 15
- B 17
- C 19
- D 21

- 30** Tom makes wooden toys to sell in his shop. The only types of toy that he makes are cars and trains. He packs the toys in three different ways:

Car boxes contain 48 toy cars each.

Train boxes contain 48 toy trains each.

Mixed boxes contain 24 cars and 24 trains.

The shop now only has toy cars in stock, but Tom is about to deliver 10 boxes of toys. When the delivery is received there will be twice as many trains in the shop as cars.

Which of the following additional pieces of information would be sufficient to work out the number of cars currently in stock?

- A** The difference between the number of car boxes and the number of mixed boxes in the delivery.
- B** The difference between the number of car boxes and the number of train boxes in the delivery.
- C** The number of mixed boxes in the delivery.
- D** The number of train boxes in the delivery.